

WALL STREET WHY THE INDUSTRY  
KEEPS SHRINKING

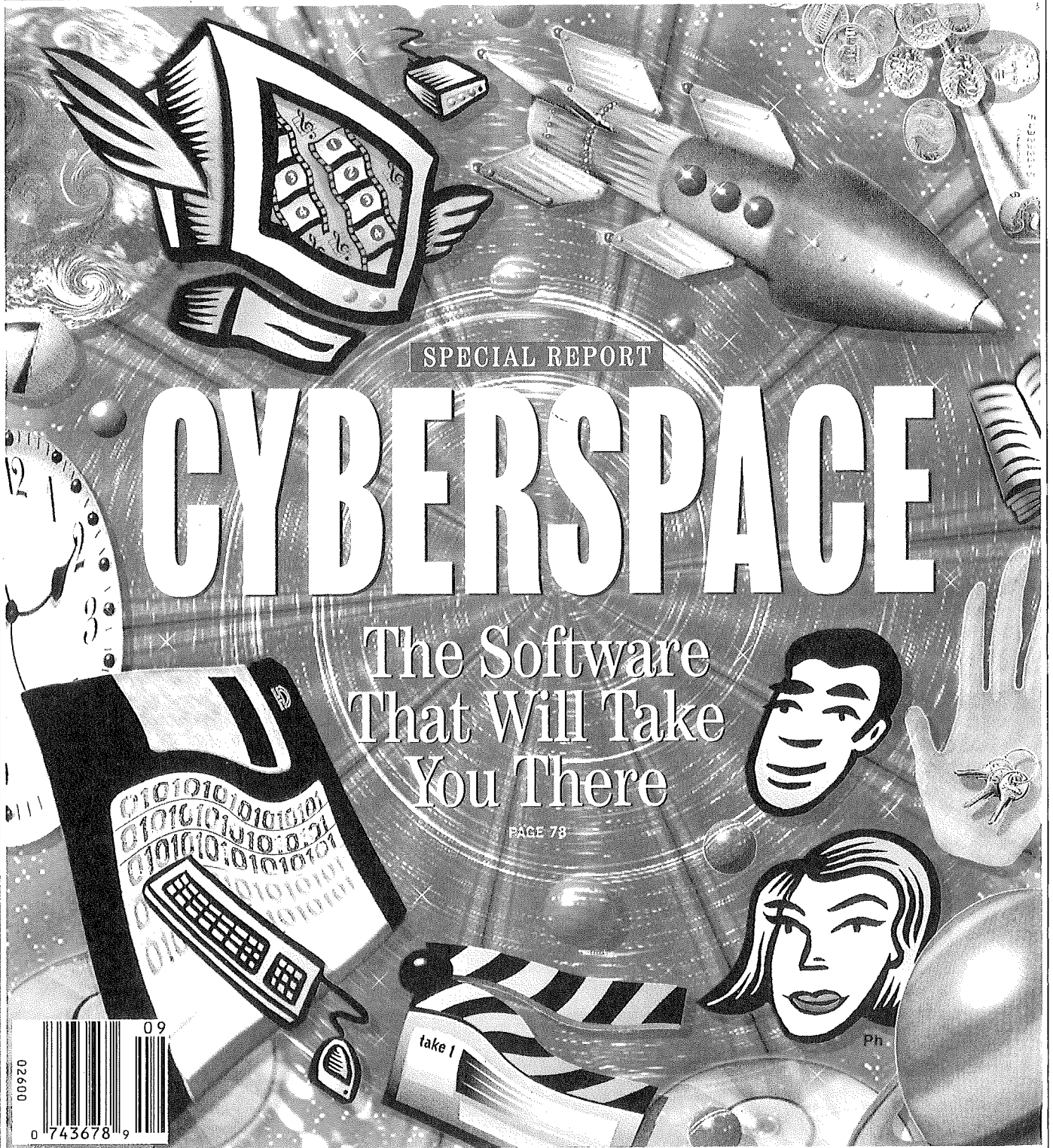
THE MICROSOFT CASE: BACK TO  
SQUARE ONE?

# BusinessWeek

FEBRUARY 27, 1995

A MCGRAW-HILL PUBLICATION

\$2.95



SPECIAL REPORT

# CYBERSPACE

The Software  
That Will Take  
You There

PAGE 78



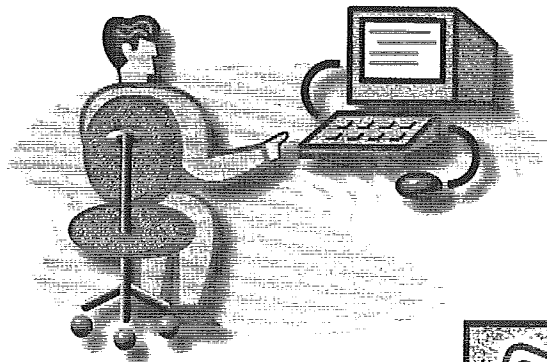
# CYBERSPACE

Crafting software that will let you build a business out there

**B**y now, the vision of our future in cyberspace is pretty familiar. From Al Gore and Newt Gingrich to Bill Gates and John Malone, dozens of academics, business leaders, and politicians have painted a detailed picture of the coming digital millennium. We'll work, shop, chat, educate, and amuse ourselves in a new online realm that will put every conceivable form of information—from a stock report to a digitized, interactive movie—instantly at our fingertips. Already, millions of people who collaborate across

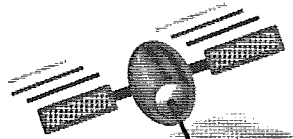
computer networks or log on to commercial online services or prowl the vast Internet are seeing a glimmer of how the vision will come to life.

They're probably seeing something else as well: Despite all the high-speed networks and powerful PCs to take you there, cyberspace—especially the uncharted expanse known as the Internet—is still not a safe, hospitable, and compelling environment for businesses and consumers. Often, it seems a harsh and unforgiving place where, with a misplaced keystroke,



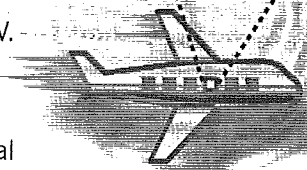
## USER INTERFACES

Browsers and navigational aids will help sift through the sea of information, helping you find what you are looking for, whether from a PC, a wireless device, or your TV. Software "agents," sort of personal assistants, will go out on the Net and fetch stock quotes or the best deal on airfares to Hawaii.



## COMPRESSION

Until networks get more powerful, compression techniques are vital for squeezing hefty video, graphics, and text files for faster transmission over the Net.



## SECURITY

Encryption technology scrambles digital signals to help keep confidential data, such as credit-card numbers, from cybersnoops.

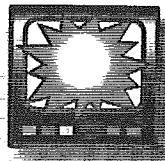
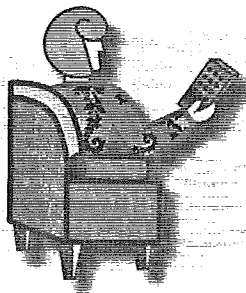


ILLUSTRATION BY ALBERTO MENA AND JAIME BEAUCHAMP/BW

Cashing in on Cyberspace

A Rush of Software Development

you can become hopelessly lost, where the information you thought you would find isn't where it should be, and where it's all too easy for villains to snatch your digital valuables—by ripping off your work or stealing your credit-card information.

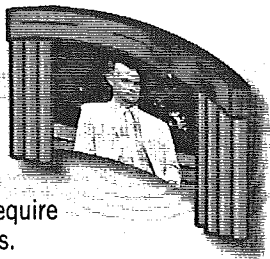
What will change all that? In a word: software. There is an enormous need for "enabling" software—to speed up transmission of huge video files, to guide you through hundreds of TV channels, to manage thousands of online transactions, and to make sure those transactions are secure. "The solution to everything on the Internet is software," says Edward J. Hogan, senior vice-president at MasterCard International Inc., which expects its member banks to start doing business on the Net this year. "Software is king."

**"LIKE THE LAND RUSH."** The great cyberspace software race has begun. At giant corporations and in basements, the brightest minds in software are working on programs that will make it possible to move vast amounts of digital information, distribute it efficiently to the correct addresses, and make it all simple enough for nontechnies to manage. From simple graphical interfaces to such cutting-edge concepts as software agents, programmers are harnessing the power of cyberspace—to help businesses and consumers meet in an electronic marketplace and to create the information systems for the virtual corporations—and communities—of the 21st century.

The players that come up with these programs could wind

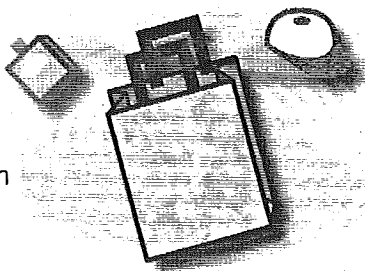
### VIDEO SERVERS

Some companies are betting that entertainment will create a mass consumer market in cyberspace. Applications such as movies on demand and interactive games will require powerful multimedia servers.



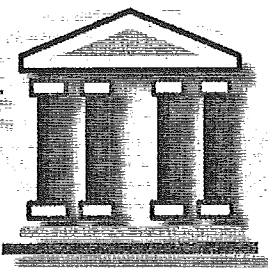
### PUBLISHING PROGRAMS

Publishers looking to move their digitized content to the Net need tools to help them create and maintain compelling outposts in cyberspace.



### RETAIL SYSTEMS

All sorts of companies are rushing to hawk their wares in cyberspace, setting up electronic malls and storefronts.



### ELECTRONIC COMMERCE

Banks and software companies see electronic banking as a big consumer market. To attract businesses to the Net, they are working on a range of projects to make networks secure.

to Create an Electronic Marketplace

up at the head of a new world order—where computing, entertainment, and communications merge. "It's like the land rush in Oklahoma," says Lawrence J. Ellison, chairman of Oracle Corp., the No. 2 software maker. "The best spot in the valley goes to the one who gets there first." Ellison, who has launched ambitious efforts to develop software for everything from serving up video on demand to home shopping and information searching, is determined to get there before No. 1

## Special Report

Microsoft Corp. And Microsoft Chairman William H. Gates III is just as determined to extend his software reign into the Information Superhighway era. Microsoft is spending more than \$150 million a year on developing all sorts of software for entertainment and information networks.

Or neither could prevail. The battle for cyberspace presents a fresh opportunity—for startups as well as for some of high tech's most venerable names. Both IBM and Digital Equipment Corp., for example, are scrambling to redeploy their software expertise for the I-way. "Software tools that collect information, organize it, and make it readily available will be perhaps one of the biggest businesses on the Information Superhighway," says William D. Strecker, vice-president of Digital's Advanced Technology group.

Lotus Development Corp., whose Notes program is now used by corporations to coordinate the activities of workers across a network, is also well positioned to help Corporate America move into cyberspace. The company is already working with AT&T on Network Notes, which will run on the phone giant's long-distance system, and developing connections between Notes and the Internet. "It's a period of dramatic change and innovation," says Erik Grimmelmann, marketing vice-president for business multimedia infrastructure at AT&T. "Inevitably, some of those on top will fall."

**USER-FRIENDLY FACADE.** The first leg of the race is well under way. It's the effort to create the kind of "user interface" that will bring millions of ordinary people into cyberspace. This ranges from programs for your desktop computer that simplify connections to your corporate electronic-mail system to software to whisk you across the Net to shop in virtual malls, visit cybershownrooms, and ring up bills at the electronic newsstand. Already, software makeovers of America Online Inc., on which BUSINESS WEEK is electronically available, and Prodigy Services Co. have converted those commercial services into a relatively user-friendly, if limited, window into cyberspace.

The most critical need, however, is to create a facade of user-friendly software for the globe-spanning Internet. A jumble of interlinked networks, the Internet includes some 4 million "server" computers, housing incalculable volumes of all sorts of information. But because there is no central control over the Net, there is also no master index. That has kept the Net largely a playground for the techno-intelligentsia who use arcane programs such as Gopher, Archie, and FTP to dig out what's hidden in all those databases.

Now, the software is emerging that will make it possible for ordinary consumers and businesspeople to do the same—making the Internet the all-purpose route into cyberspace. The big breakthrough began in 1993 with the creation of an Internet subnetwork called the World Wide Web—really just a clever software scheme for imposing order over the mass of free-form information on the Net by organizing it in easily understood "pages."

What makes the Web such a powerful cyberhelper is a software technique known as hyperlinking. When composing a Web page, an author can create hyperlinks—words that appear

in bold type and indicate a shortcut to some other information. Using a program known as a Web browser on your PC, you can read pages stored on any Web computer. Say you're reading a page that describes recent discoveries about allergies. You see the word "antigen" in bold type. Using your computer mouse, you click on the word

## Special Report

and—without any further effort on your part—you are transferred to another Web page that tells you what an antigen is. That page could be in the system where the first page was or in another computer thousands of miles away.

**THE SURGE IN BROWSERS.** The Web is emerging as the laboratory for learning how to do business in cyberspace. Companies of all stripes are experimenting. Club Mediterranee has Web pages describing its resorts. IBM has posted its annual report. And on Feb. 14, Fidelity Investments launched a "home page" with descriptions of its funds, a worksheet for college planning, and a sample of its personal-finance software that Internauts can download. Log on to the Web computer of Philadelphia-based CDnow! and you can order from its online catalog. Click on an album title, and see the names of the songs. Another hyperlink will get you to reviews. With a click of the mouse, you can toss an album into your "shopping cart." When you're done, you order by sending your credit-card number over the Net.

As Web use has exploded—there are now 27,000 Web sites, and the population is doubling every 53 days, according to Sun Microsystems Inc.—Web browsers have become an overnight software sensation. Millions of copies of Mosaic, the original Web browser, have been distributed for free over the Net. Still, companies are piling into the browser business—often with up-

grades of Mosaic. Spry Inc., a Seattle-based startup, sells Internet-In-A-Box. Quarterdeck Office Systems Inc., a PC software maker looking for new life, sells a series of Web products, and startup Netscape Inc. offers Netscape Navigator, written by Mosaic creator Mark Andreessen. At the same time, big players, ranging from Prodigy and America Online to Microsoft and Novell, are building Web browsing into their software.

The Internet is not the only focus of the software race. Virtually all major computer and software makers are working on interface programs to help office workers move smoothly from their desktops to corporate networks and beyond. One approach is the "universal browser," intended to mask the boundaries between various computers and networks. Instead of having to figure out where the information is buried—and then trying to somehow connect with the right system—a computer user will simply specify what kind of information is needed. "Where it comes from, how it got there, will recede into the background," says AT&T's Grimmelman.

Novell Inc., the leading supplier of software to run local-area networks, is testing a universal browser code-named Corsair. It uses cartoon-like pictures to help you get your bearings. For example, a screen depicting an office shows a desk, Rolodex, phone, mailbox, and file cabinets. When you're going beyond your own organization, you click on the office window and are transported to a screen with a colorful picture of the world outside your virtual window: a leafy village with a shopping center, a city hall, a bank, and a business park. Clicking on the business park might call up a yellow-pages listing that displays information services you can connect to.

Similar programs are under development across the computer industry. IBM is working on one for its OS/2 operating system, and Computer Associates International Inc. is putting

## WHAT'S THE COLOR OF CYBERMONEY?

**D**oing business in cyberspace sounds like a great deal—low overhead, no real estate, no traffic. But how are you going to get paid? Or pay for what you buy?

Electronic payment systems are among the most challenging issues facing programmers. It's relatively simple to create digital equivalents of checking and credit-card accounts—and to protect them with encryption—but that's only part of the answer. Electronic replicas of those account systems won't be well suited to making "micropayments" for snippets of information that will be bought and sold on the Internet.

And there's another issue. When consumers start doing business across the untamed Internet, they will vastly increase the chances that confidential data about them can be compiled. Those risks exist now, but on the Net, every transaction leaves a trail—that a hacker, an aggressive marketer, or the government could pick up. And it's more than Internet purchases: Credit-card issuers are plan-

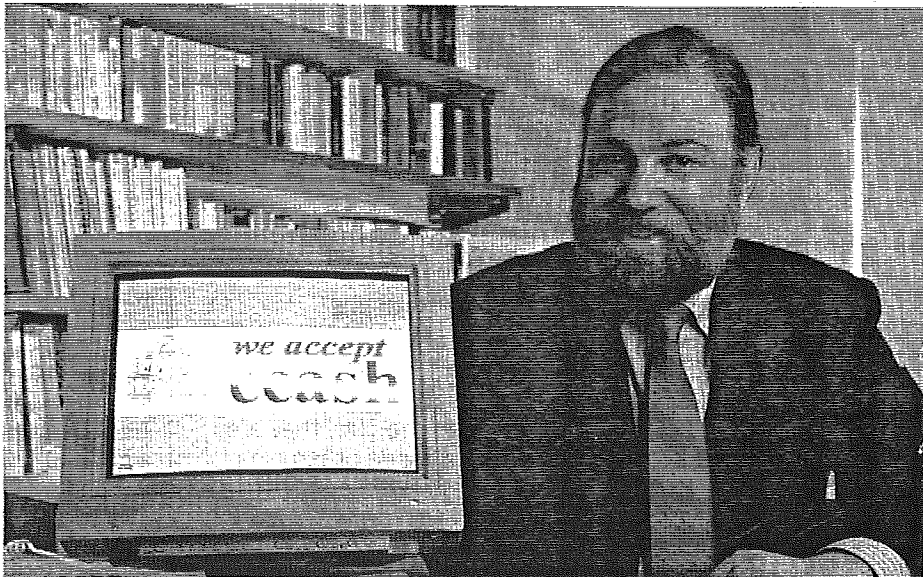
ning "smart" cards for use with everything from pay phones to public transit. "The potential for invasion of privacy becomes severe," says Don Tapscott, director of the Alliance for Converging Technologies, a private research outfit.

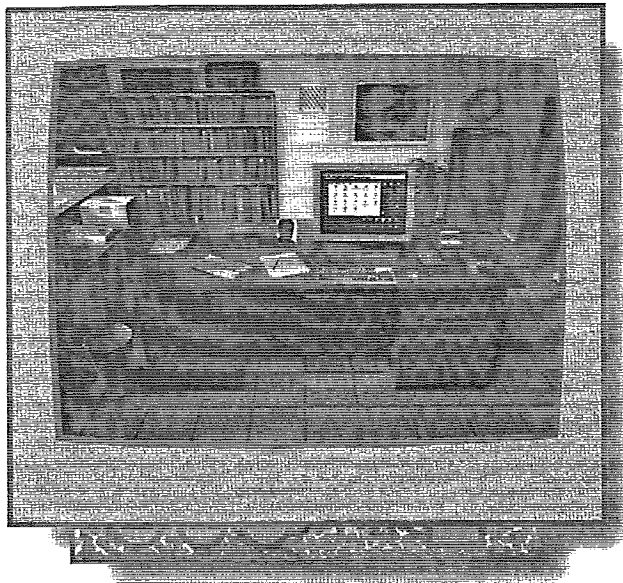
One answer is to create the electronic equivalent of cash—digital money

that can be loaded onto your hard drive or a wallet card and used as freely—and anonymously—as cash. That's the idea behind First Virtual Holdings, which runs a kind of private currency system on the Net, and DigiCash, a Dutch software startup.

DigiCash's "ecash," now being tested

**A CONTENDER**  
Ecash, developed by Chaum, is being tested on the Net





## PERSONAL COMPUTERS

Software makers are creating graphical user interfaces that make it easy to tap into a network—whether it's your corporate database, an E-mail system, or the Internet. Novell's Corsair program mimics a real-world landscape. A built-in searching program called Ferret retrieves information for you.

the finishing touches on a package called CA-Simply Village. In addition to three-dimensional graphics of familiar images, Simply Village has speaking cartoon characters to help guide you through using a variety of consumer services.

Microsoft's approach is embodied in Windows 95, the new Microsoft operating system due out this August. It has built-in links to the Internet and to the forthcoming Microsoft Network, an online service. In addition, it's organized to help workers move seamlessly between files on a PC and

those on a local-area network or on a computer on the other side of the ocean—all through a series of screen icons. Windows 95 also includes a technology called Object Linking & Embedding (OLE), which is similar to hyperlinking.

So far, the hottest startup in the cybersoftware race is General Magic Inc. Its initial public offering came out at \$14 on Feb. 10 and traded as high as \$34 that day—despite five years of losses and scant revenue. What has investors so excited is a pair of products that could greatly simplify getting

on the Internet, is the brainchild of company founder David Chaum, a former computer-science professor at the University of California at Berkeley. Like other electronic payment systems, ecash is protected with encryption technology. With a credit-card or electronic checking, encryption stops snoops from stealing your account numbers from the Net. But merchants and card issuers still get purchasing information.

### Companies on the Trail of Electronic Money

**CYBERCASH** Working with Wells Fargo on a system to encrypt credit-card data

**DIGICASH** Wants to create the digital equivalent of cash—totally anonymous and universally accepted

**FIRST VIRTUAL HOLDINGS** Has launched an E-mail system for small transactions

**MICROSOFT** Developing a specification for credit-card transactions with Visa

**MONDEX** This British banking venture is developing a smart card system for electronic cash

**NETSCAPE** Building encryption and validation into its Web software with partners MasterCard, Bank of America, MCI

With ecash, the encryption not only protects the money from snoops and thieves but also obscures the identity of the owner. Here's how: When you want cash, you make an electronic withdrawal from your bank account. The bank issues electronic currency—a series of encrypted serial numbers representing dollar bills and coins. Once the encrypted money leaves your account, it can no longer be traced back to you—not even by the issuing bank. When you spend it, your digital coins get deposited directly to the merchant's ecash account.

**NERVOUS BANKERS.** While ecash can't guarantee your privacy—merchants can still keep track of where they send their wares—it does play an important role in making the I-way a better place to do business. With a digital cash system in place, anyone with a computer and a modem could peddle their ideas or wares on the Net—whether a short story, a work of digital art, or investment advice.

Not everyone is cheering. Banks, credit-card issuers, and the Internal Revenue Service are less than eager to see untraceable digital money catch on. "We are the antithesis of anonymous cash," says Richard M. Lonergan, senior vice-president for point of transac-

tion at Visa International. The credit-card giant is working with Microsoft Corp. on a secure electronic credit-card setup for the Net.

Banks could be the biggest losers. In the ecash pilot, DigiCash acts as its own bank—but it is just playing with digital Monopoly money for now. Even though Chaum hopes to work with leading banks, there's really no need to. And that has some bankers alarmed. "We have to ensure that we own a piece of every transaction, whether it's a movement of funds or information," says Charles H. S. Mallis, global marketing executive for global payments and treasury services for Chase Manhattan.

In the end, there will likely be multiple payment methods in cyberspace, just as in the real world. Microsoft, for example, has a credit-card venture with Visa but is quietly looking into electronic money, too. And Wells Fargo & Co. is looking into electronic cash. "It's fairly clear that there has to be action on the part of banks," says Maria Mandler, senior product director at Citibank global cash-management services, "or I'm sure other organizations will fill the gap." With digital cash, perhaps.

*By Amy Cortese, with Kelley Holland, in New York*

around in the online world. Magic Cap, designed initially for use on handheld gadgets, uses a series of metaphorical scenes: your office, the hallway outside, and a downtown. By simply pressing on the icon representing an out box, you can send a

memo to a dozen co-workers on a mailing list via a wireless data network. Magic Cap is

## Special Report

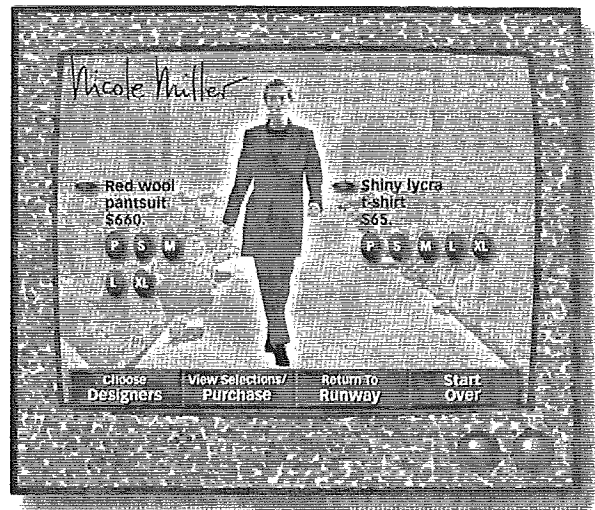
being used by Motorola Inc. and Sony Corp. in their personal digital assistants.

But it's General Magic's other product, Telescript, that really shows promise. A software language for creating applications on a network, Telescript includes a new technology called software agents. Agents can act on their own to get something done for you. So, for example, an agent could be programmed to automatically scour the Net for the best deal on, say, a 30-year fixed mortgage—and order up an application form. The first Telescript application will be PersonaLink, an “intelligent” messaging service being launched by General Magic backer AT&T. While AT&T says the system will eventually handle such tasks as doing your online shopping, at first the agents will do simpler chores, such as routing E-mail messages.

**“NOT FOR THE FAINT OF HEART.”** For now, creating electronic shopping assistants isn't a top priority. What's needed first is software to keep people from drowning as they sift through a sea of information to find exactly what they want. Every day, that sea grows deeper: There are now some 5 million documents stored on Web servers, estimates Michael Mauldin, a research computer scientist at Carnegie Mellon University. That figure is doubling every six months to a year, he figures.

At Carnegie Mellon, Mauldin and his team have created what he calls a software “robot.” Running simultaneously across four powerful workstations, the system is called Lycos, after the Lycosidae spider, known for pursuing its prey relentlessly. Lycos goes out onto the Web and catalogs the continually expanding number of documents posted there by scanning them and creating an abstract containing the title, first 20 lines of text, and the 100 most important words. Since beginning its mission last June, Lycos has cataloged 270,000 documents—a mere 5% of what's on the Net. Mauldin says it will take 12 computers running Lycos to keep pace with the growth of Internet information.

Oracle, the top supplier of database programs for minicomputers, is also working on ways for ordinary folk to find needles in digital haystacks. Last fall, it announced plans to adapt a “natural language” search program called Context for

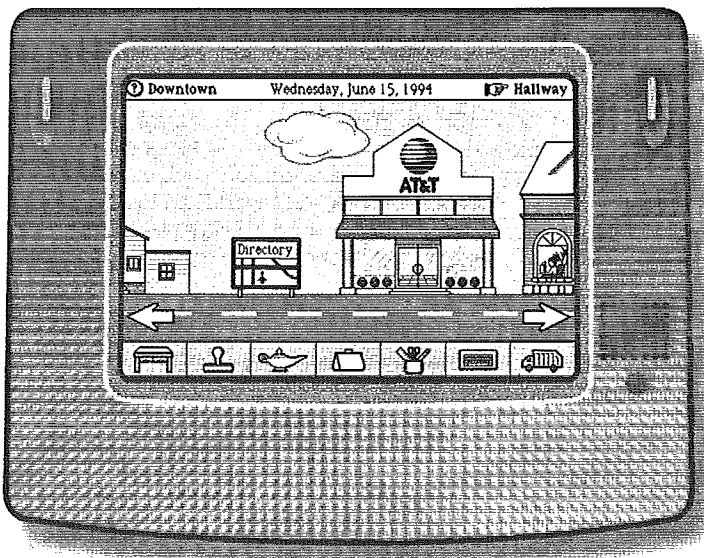


**INTERACTIVE TV** Trials are beginning in earnest this year. Oracle's I-TV software offers services such as home shopping.

the Internet. Using simple English—rather than stilted computerese—you can ask Context to search the entire Net for specific information.

Context is only a tiny part of Oracle's I-way effort. Its primary target is the software to run video “servers”—powerful computers with massive arrays of disk drives that can run interactive-TV shopping channels or dish out video on demand across cable-TV or phone networks. So far, the company has contracts with British Telecom, Bell Atlantic, and Time Warner to build servers for interactive-TV trials. At the other end of the line, Ellison is looking at interface software: One reason he has considered mounting a takeover of Apple Computer Inc., say Ellison associates, is that he believes Macintosh software could be the basis for an I-way interface—for computers and cable-TV set-top boxes.

Ellison is also pushing his company into the business of selling software that will create digital content. The first program, Media Objects, is now in prerelease testing. Another



ILLUSTRATIONS BY LISA KNOWSE BRAINMAN/BW

**HANDHELDS** A new crop of handheld computers and personal communicators will connect you to the Net through wireless transmission. General Magic's software “environment” gives users a simple interface through which to pull down stock quotes or fire off E-mail on the go.

project, the World Wide Web Kit, is aimed at helping current customers link their Oracle databases to Web pages.

Although it got a later start, Microsoft is attempting to match virtually every Oracle move in I-way software. While Oracle has snagged the biggest phone contracts, Microsoft has lined up cable giant Tele-Communications Inc. and Rogers Cable in Canada. TCI plans to use Tiger, a Microsoft video-server program, to provide movies on demand. Microsoft is also developing channel-surfing software for set-top boxes and software "tools" to help businesses create content for the Microsoft Network.

The high-stakes contest to build software for interactive TV has attracted other players as well. Hewlett-Packard, DEC, Silicon Graphics, Sun, IBM, and Sybase are all betting chunks of their research and development budgets. "The race is going to be won by those people who have guts and are willing to spend money now," says Andrew T. Eiseman, head of technology for U S West Communications Broadband & Multimedia Services, which is testing a DEC server and set-top boxes from game maker 3DO Co. "This is not for the faint of heart."

While the big guys slug it out in interfaces, information retrieval, and video-server programs, there are lots of niches for others. Take eShop, a four-year-old San Mateo (Calif.) startup. It has come up with three programs to help merchants set up their own distinctive virtual stores. One creates an electronic storefront. Another is a "warehouse" package that manages product and customer information and routes transactions. And the third is a browser for electronic catalogs—whether they're on the Web or on interactive TV. eShop plans to take a cut of the revenues from retailers and has licensed its software to AT&T, which is developing a shopping service for its PersonaLink service. Another client is Tower Records, which is testing an electronic shopping system.

**PERSONAL NEWS.** Software to help publishers go online is another thriving niche. One of the leaders in electronic publishing software is WAIS (Wide Area Information Servers). Its WAISserver system will handle billing, registration, advertising tracking, and just about anything else a publisher needs. WAIS also offers intelligent-agent and information-searching software, which WAIS president Brewster Kahle helped develop at supercomputer maker Thinking Machines Corp. Customers include Dow Jones & Co., which is testing an electronic version of *The Wall Street Journal* that lets subscribers specify what news they want to get—by selecting company names and sections of the regular paper. "This is the start of the personal news service," says Kahle.

Before publishers—or anybody else—start doing a lot of business in cyberspace, there's another software issue to deal with. How do you make sure information used in electronic transactions can't be tampered with? How can a seller be sure a virtual customer is who he claims to be? And what con-

sumer wants to trust the network with a credit-card number?

Partly because there have been few answers, business volume across the Net has been modest. Roughly \$200 million worth of credit-card transactions took place over the Internet last year—barely a drop in the bucket: Visa alone rang up \$640 billion in charges in 1994. And most Internet purchases were offline—the buyer browsed the Net then ordered by phone. For good reason: "Passing your credit-card number over the Internet today is like getting dressed with the light on when it's dark outside," says Richard K. Crone, a senior manager in KPMG Peat Marwick's financial-services consulting practice. That's holding back electronic commerce in general, says Richard M. Lonergan, senior vice-president for point of transaction at Visa International.

Recent security breaches on the Internet have done nothing to help. "This could potentially be a fantasy for hackers worldwide," says Joel Friedman, a specialist in banks and credit cards at Andersen Consulting. And the efficiency of the Net increases the potential damage: a cybersnoop could fire off dozens—even hundreds—of phony transactions in just a few minutes. "Consumers are hearing it's insecure, so stay away from it," says MasterCard's Hogan. "We have to go through a PR effort to undo that."

**SECURITY TEST.** Software companies, banks, and researchers may have the solution in hand. There are at least a dozen initiatives under way (page 80). Microsoft is working on several secure payment systems, including one with Visa for credit-card transactions. Netscape has built encryption into its browser and Web-server software. CyberCash, a Vienna (Va.) startup, is working with banks such as Wells Fargo & Co. on electronic payment systems.

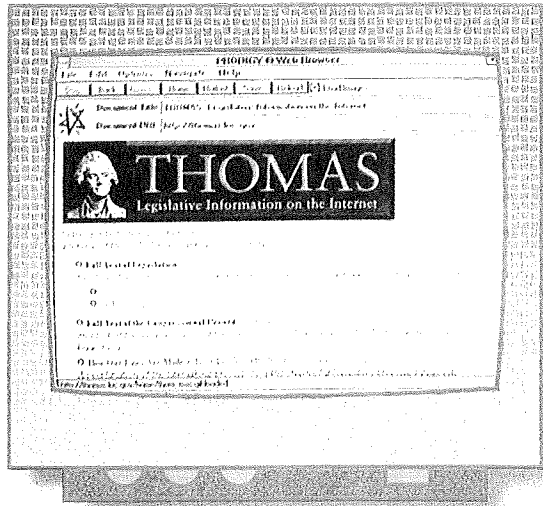
Many of these systems will be tested this year. Wells Fargo Bank, for example, plans to start a secure credit-card pilot next month with 10 to 20 merchants. The system will go "live" in April, available to any merchant doing business with Wells. The bank also plans to offer debit cards on the Net. MasterCard says it will test a secure credit-card service on the

Net by midyear and hopes to offer it commercially by fall. Visa and Microsoft, meanwhile, plan to have a payment system in place by yearend. And DigiCash, a Dutch startup, is working on something called ecash, a sort of digital currency that will be useful for small-scale purchases—from 5¢ to \$5—on the Net.

Whether it's digital cash, debit cards, or credit cards, the new electronic payment systems all will be secured by some form of encryption—software algorithms that scramble digital bits of information so they cannot be read by unauthorized eyes. The most promising form is the "public-key" method and the most popular public-key system is being licensed by RSA Data Security Inc. (page 86).

One by one, as I-way software issues are tackled, the I-way software business could disappear. How? All the various programs needed to create, move, and view digital "content" will be built into other software. That's already happening with HTML (hypertext markup language), the software format

## Special Report



**ONLINE SERVICES** Prodigy is the first of the major commercial online services to offer full access to the World Wide Web. Subscribers can view Web "pages" through Prodigy's browser.

used to create Web pages. The leading makers of word processing programs—Microsoft and WordPerfect Corp., a division of Novell—have announced plans to add HTML to their packages. And Lotus' new InterNotes Net Publisher converts Notes documents to the Web format. Even IBM is reworking its main-

## Special Report

frame database, DB2. The new DB2 World Wide Web will provide access to corporate data from the Internet.

In fact, one measure of the success of the cybersoftware ef-

fort will be how quickly the new programs seem to vanish. If businesses are to operate efficiently online and consumers are to enjoy their time in cyberspace, the programming that makes it all possible must be invisible. Only then will those visions of life in cyberspace come true.

By Amy Cortese, with John Verity, in New York, Russell Mitchell and Richard Brandt in San Francisco, and bureau reports

America Online users can chat with the authors on Sunday, Feb. 19, at 9 p.m. EST in a BUSINESS WEEK Online conference.

# THE KEY TO SAFE BUSINESS ON THE NET

**T**hey came from AT&T. Oracle. National Semiconductor. Adobe Systems. Visa International. Speaker after speaker, more than 20 in all, crowded about tiny RSA Data Security Inc.'s products at a conference hosted by the company. "Gee," said a friend who whispered into RSA President Jim Bidzos' ear. "You must have pictures of all these guys with hookers, naked."

Well, no. What RSA has is something really useful—software to

and less than \$10 million in sales. But with computer and online companies and giants such as Visa International and MasterCard International Inc. using RSA technology, the company is poised to take off. How big? "It'll be a nuclear explosion," says Bidzos. He figures revenues will double each year.

The fuel is a rather simple concept. Each party in a transaction holds two software "keys." Public keys are published, like listed phone

So far, nobody has cracked the code, despite an annual RSA hackers contest. RSA figures it would take a supercomputer hundreds of hours to get just one credit-card number. The biggest risk, then, is sloppy protection of a private key.

**SIGNING UP LOTUS.** RSA's success comes almost in spite of itself. Its technique was invented by Stanford University researchers in 1977. Three Massachusetts Institute of Technology professors—Ronald L. Rivest, Adi

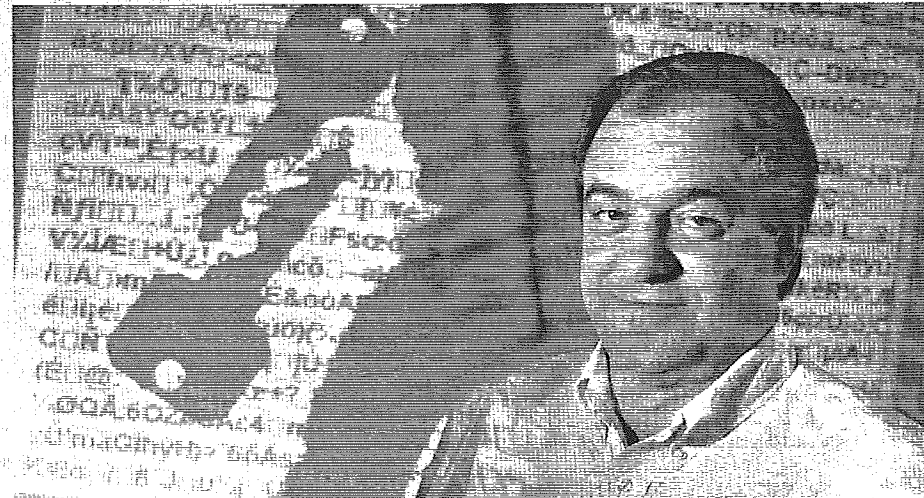
Shamir, and Leonard M. Adleman—made it a usable system, then founded RSA and nailed down crucial patents. But, says Adleman, now a professor at the University of Southern California, his "lack of aptitude in business" almost sank the company. Rivest, the chairman, is the only founder still active in RSA business.

When Bidzos, a marketing expert, arrived in 1986, the company "was \$750,000 in debt and had no customers," he says. That year, RSA signed up Lotus Development Corp., which uses the technology in Notes. Since then, the client

list has swollen. The latest: AT&T and VLSI Technology Inc., which will use RSA algorithms in encryption chips.

Will the love-in last? RSA's main patent expires in five years, and Viacrypt, a tiny company that licenses RSA technology, is mounting a challenge—but with little success thus far. A big factor in RSA's favor: Although it's in a position to do so, it is not gouging on price. "They have not been piggy," says Edward J. Hogan, senior vice-president at MasterCard. Even now, says Bidzos, "I don't see us raising prices." That's how to win friends and influence people.

By Russell Mitchell in Redwood City, Calif.



make doing business in cyberspace safe. Outside of spy agencies, RSA's "public-key encryption" is regarded as the best security there is. Ask RSA's big-name clients—Apple, Microsoft, Motorola, and Lotus. "Public-key cryptography is a cornerstone of the Information Superhighway," says Nathan P. Myhrvold, Microsoft Corp.'s senior vice-president for advanced technology. "And RSA is the most widely accepted public-key system."

Acceptance didn't come overnight. The privately held Redwood City (Calif.) company took 12 years to reach its current size: 45 employees

## DIGITAL LOCK Bidzos challenges hackers to crack RSA's code—but so far no one has

numbers. Private keys are known only to their holders. Both keys are needed to encode and decode a message.

Example: To buy flowers on the Internet, you encode your credit-card

number using the public key of the card issuer. The only key that unscrambles the data to complete the transaction is the issuer's private key. Or you send E-mail coded with your private key and the receiver uses your public key to decode it. Since the public key unlocks only messages that were encoded with your private key, the receiver can be sure you're the sender.